SWG/12 Maritime Environmental Protection Strategy

by

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Introduction: NATO naval ships operating in the 21st century will be expected to meet increasingly stringent environmental regulations. Special Working Group 12 (SWG/12) has a comprehensive shipboard pollution abatement program under way that will enable ships of the 21st century to be environmentally sound. The goal is for ships to operate worldwide with minimal potential for regulatory constraints, no inappropriate dependence on shore facilities, and no unreasonable costs imposed by environmental regulations. The basic strategy is to: design and operate ships to minimize air emissions, waste generation, and optimize waste management, and, where required, develop shipboard systems that will destroy or appropriately treat the wastes generated on board. If wastes are unavoidable and cannot be destroyed or sufficiently treated so that overboard discharges are not considered environmentally significant, they must be retained on board for recycling or treatment ashore.

Although the ultimate solution for on-board destruction has not been achieved for any shipboard wastestream, the members of SWG/12 have made considerable progress toward developing on-board capabilities for managing, treating, or processing solid wastes, oily wastes, hazardous materials, and medical wastes. They are still seeking satisfactory interim or long-term solutions for treating blackwater and graywater, but they have identified technologies with potential to treat these wastes, and development programs are in hand. International cooperative efforts to achieve environmentally sound ships are under way among NATO navies to share information and technologies, and to save time and money.

Description of the problem and proposed approaches: During the last 15 years, several international regulations have been adopted that significantly affect NATO navies. The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) contains several annexes of which some are in effect and some have yet to enter into force. Annexes in effect include Annex I which essentially eliminates all oily waste discharges at sea and Annex V which prohibits the discharge of plastics anywhere and the discharge of solid wastes (except food waste) into special ocean areas. Annexes yet to come into force include Annex IV which proposes to prohibit the discharge of untreated sewage (blackwater) within specific distances from special areas' shores and Annex VI which proposes to limit air emissions from ships. Proposed regulations include restrictions on the use of certain underwater hull coatings for protection from fouling marine growth and a protocol for managing ballast water to prevent introduction of non-indigenous species of marine life. The other significant international treaty of concern to military ships is the Montreal Protocol which eliminates production of certain ozone depleting substances (ODS) including chloro-flouro-carbons (CFCs) and Halons.

Sovereign nations have the right to determine which international regulations they will ratify regarding environmental requirements. Nations then determine the applicability of specific international regulations to their military ships through domestic legislation. The decision by a nation to apply the requirements of the MARPOL 73/78 and/or the Montreal Protocol to their military ships demands the development of new technologies, management procedures, and the

installation of equipment into densely packed ships. Complying with these regulations affects ship operations, endurance, manning, maintenance, and the quality of life on ships. Additional impacts on planning, programming, and budgeting are also incurred from the costs of compliance at sea and the costs of installation and use of shore-reception facilities.

In addition to international regulations, increasingly complex and stringent national environmental regulations are being legislated in many NATO nations as well as other nations around the world. The national regulations are concerned with controlling ship-waste effluents in territorial waters and affect the off-loading of all ships' waste in port. Military ships have sovereign immunity, however, when adopted by authorities as conditions of port entry, these regulations could challenge the ability of NATO navies to enter ports they previously visited without restrictions. Any mistake has the potential for financial, legal, and political repercussions as well as damage to the public image of visiting navy ships.

NATO navies need to take action to prevent pollution or control pollution. NATO navies need to identify, properly manage, and process all wastes generated on ships, all hazardous materials used on ships, and all discharges from ships. For each potential environmental pollutant or problem, one or more of the following three actions is essential: reduce the use of environmentally harmful chemicals; reduce the amount of waste generated on board; and increase the treatment, processing, or destruction of wastes on board. The first two actions generally are considered pollution prevention and the third, pollution control.

Eliminating the use of environmentally harmful chemicals, such as ozone-depleting substances, toxic antifoulant hull coatings, and other hazardous materials, may be the best approach for some potential problems. Reducing the amount of waste generated on board may be the preferred approach, in some cases, over on-board waste treatment. As examples, reducing the amount of plastics or unnecessary packaging and packing material taken aboard may be worthwhile to simplify shipboard solid and plastics waste management. Similarly, reducing the volume of liquid wastes generated on board (such as bilgewater) may simplify on-board treatment. For the wastes and hazardous materials that cannot be eliminated through pollution-prevention measures, NATO navies need to develop management practices, pollution-control strategies and technologies that are suitable for shipboard use and applicable to the wastestreams generated on ships. Incorporating these measures early in the ship-design process will optimize the effectiveness of pollution-prevention and pollution-control techniques and reduce consequent life cycle costs and manning impacts.

Conclusions: NATO ships operating in the 21st century will need to be designed from the keel up to be environmentally sound. Nations should cooperate to share technology and save time and money. Information exchange within NATO's Partnership for Peace program will greatly assist our pollution prevention efforts.

Maritime Environmental Protection Strategy

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Contents

Situation

International Regulations - Mid 1970's

- MARPOL 73/78 Places Discharge Restrictions on Ships
  - Annex I - Oil Pollution
- Article 3 Exemption for Public Vessels
  - Comply as Far as Reasonable and Practicable
    - Pump and Dump as Required
- Navies Begin Waste Disposal R&D Efforts

Situation (cont.)

Regulations Evolve - Mid 1980's

- Increasing Pressure to Preserve Quality of Life
- Nations Concerned with Beach Litter
- MARPOL Annex V on Solid Waste Enters into Force
  - Prohibit Discharge of Plastics Anywhere
  - No Discharge Special Areas
- National Laws Begin to Place Environmental Requirements on Navies

Situation (cont.)

Regulations Continue to Evolve - 1990's

- MARPOL Annex VI (Air Pollution)
- MARPOL Annex IV (Sewage)
- Proposed MARPOL Annex on Ballast Water and Invasive Species
- Proposed MARPOL Annex on Anti-Foulant Paints
- Coral Reefs
- Marine Mammals

Policy

- Provide Properly Equipped, Trained, and Ready Forces that Execute their Military Mission with Minimal Impact on the Environment
- Develop Management Procedures and Technical Capacity to Act in a Manner Consistent with MARPOL 73/78 Regulations as Far as Reasonable, Practicable, and Affordable

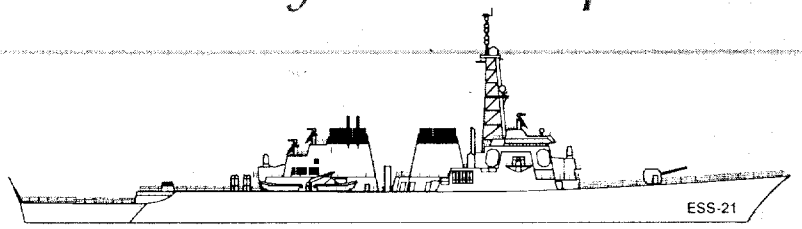
Principles

- Compliance
- Conservation
- Cleanup
- Pollution Prevention
- Training
- Environmental Leadership
- International Cooperation

Objectives

- Environmentally Sound Ships
  - Requirements Integrated into Ship Design
- Waste Management Systems
  - Ship
  - Shore
- Environmental Management Systems

Environmentally Sound Ship Attributes



- Fully Mission Capable
- Compliance with Environmental Regulations
- No Significant Adverse Environmental Impacts
- Minimum Use of Hazardous Materials
- Minimization of Air Emissions
- All Waste Streams Sufficiently Treated or Destroyed on Board Ship
- No Inappropriate Dependence on Shore Facilities for Waste Offload
- Minimal Logistical Costs for Waste Management

Methods to Achieve Environmentally Sound Ships

- Pollution Prevention
  - Reduce the Use of Environmentally Harmful Chemicals
  - Reduce the Amount of Waste Generated on Board
- Pollution Control
  - Increase the Treatment, Processing, or Destruction of Wastes on Board

Afloat Waste Reduction Efforts

- Alternative Packaging
  - Non-Plastic
- Hazardous Material Control and Management
  - Centralized Issue, Return, and Reuse
- Pollution Prevention Afloat
  - Alternative Technologies, Materials, and Processes

Typical Acquisition Strategy

- Market Survey
- Test and Evaluation
- Refine Requirements
- Marinize Equipment when Required
- Develop Equipment if Not Commercially Available

Early Years

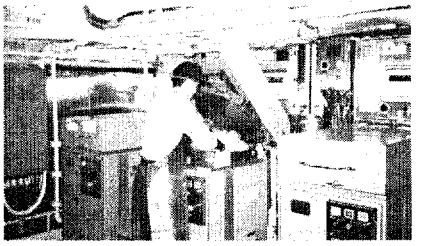
- Tested Commercial Compactors and Incinerators
  - Deficiencies Included Reliability, Maintainability, Safety, and Sanitation
  - Shipboard Incinerators Suffered Reliability Problems and Created Fire Hazards
- Tested Commercial Oil Water Separators and Oil Content Monitors
  - Deficiencies Included Performance, Reliability and High Logistic Support Costs
- Adopted Vision of Environmentally Sound Ships

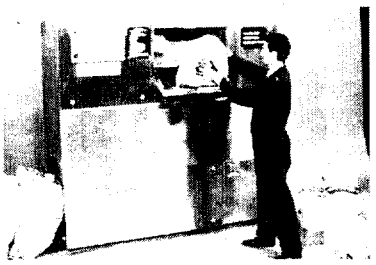
Navy Constraints

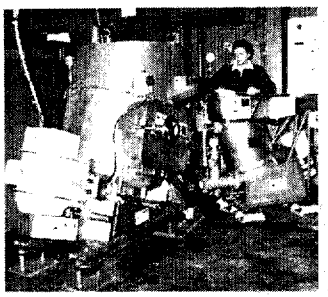
- Real World Requirements
  - World-Wide Operations
  - Long Mission Duration
  - Military Mission Effectiveness Can Not Be Compromised
- Real World Ships
  - Existing Fleet - What You See is What You Get
- Real World Budgets
  - Backfit is Expensive
    - Installation is 5 to 7 Times Procurement Cost

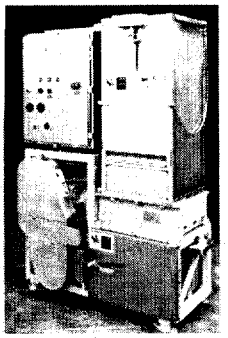
Typical Solid Waste Solutions

- Plastics Waste Processor (PWP) System
- Garbage Processing Machine
- Solid Waste Pulper
- Metal and Glass Shredder



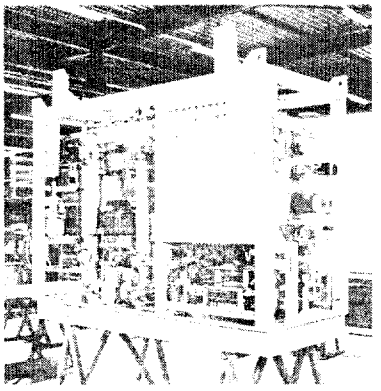


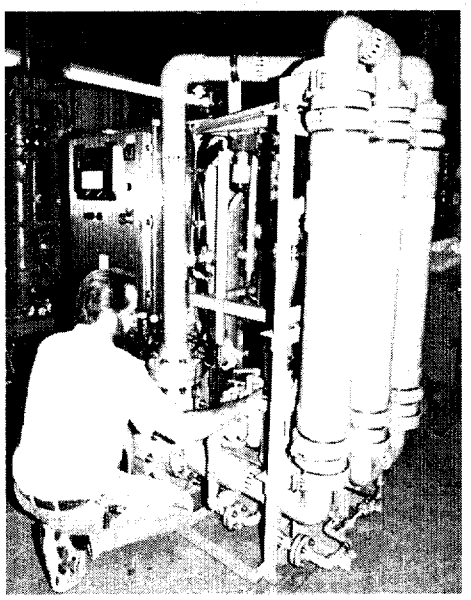




Typical Liquid Waste Solutions

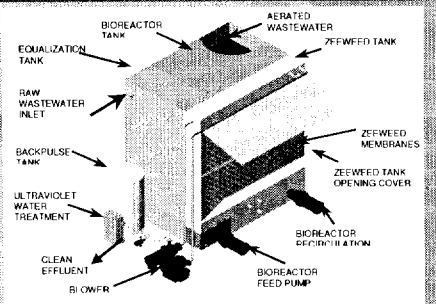
- Oil Filtering Equipment Employing Membrane Technology
  - Ultrafiltration or Microfiltration

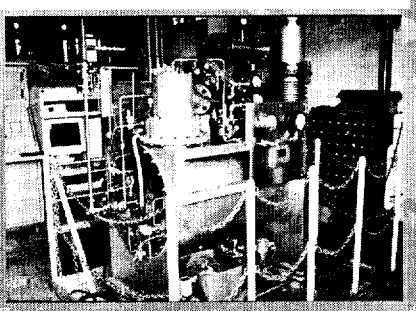




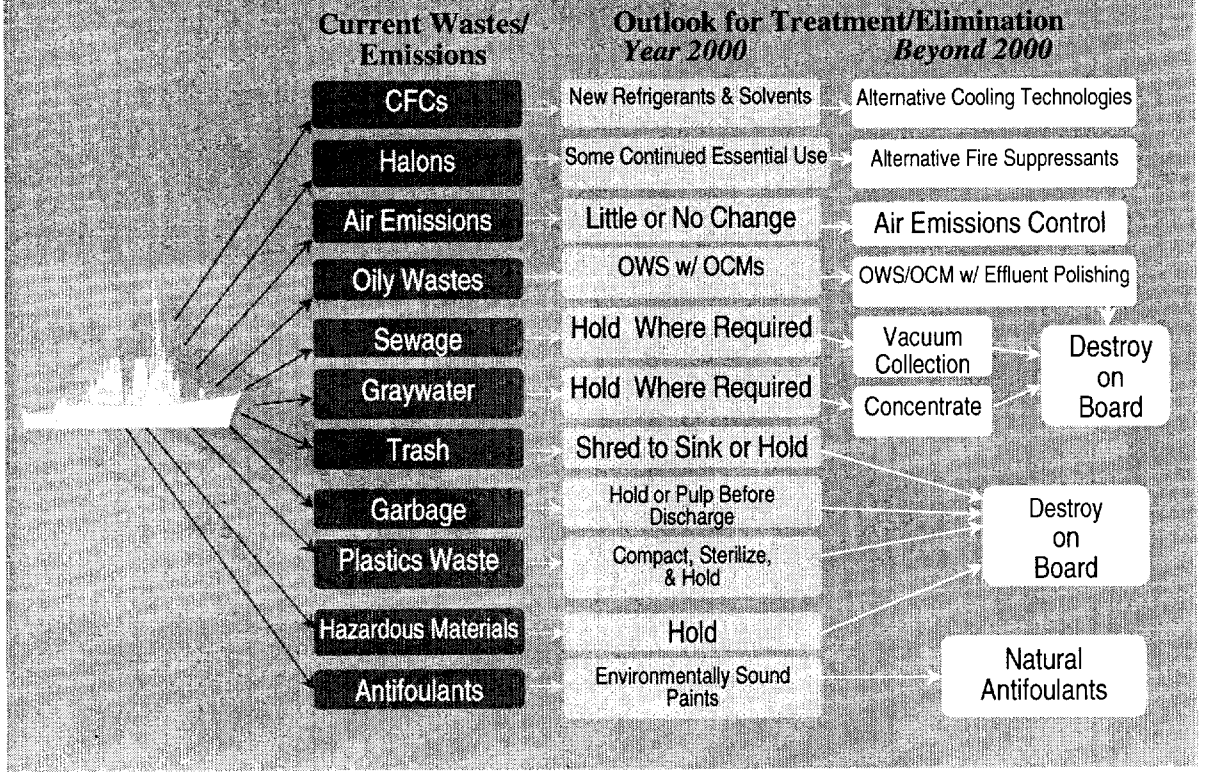
Typical Liquid Waste Solutions

- **Blackwater**
  - Biological/Membrane Treatment System
- **Graywater**
  - Membrane Concentration System
- **Integrated Liquid Waste Discharge System**
  - Advanced Vortex Incinerator





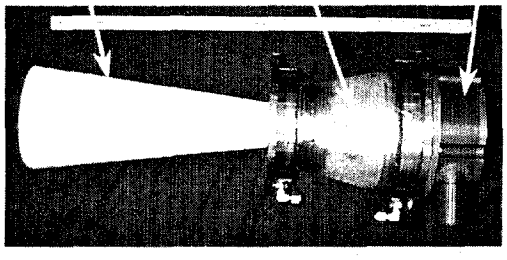
NATO Strategy for ESS-21

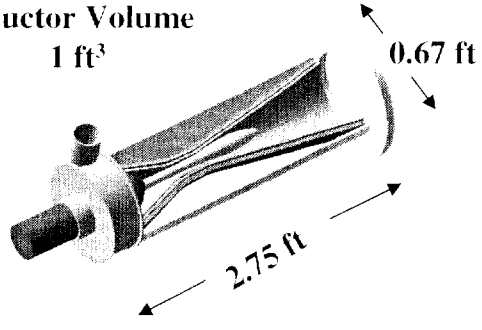


Requirements for Tomorrow!

- Thermal Destruction for Solid Waste
  - Advanced Incineration
  - Plasma Arc
- Thermal Destruction for Liquid Waste
  - Advanced Vortex Incineration
    - Blackwater, Graywater, and Oily Water Concentrates
- Integrated Thermal Destruction System
  - Capable of Meeting Solid and Liquid Waste Destruction Requirements
- Improved Management Systems for Short Duration Waste Holding
  - Small Ships Exceptionally Challenging

Plasma Fired Eductor Geometry

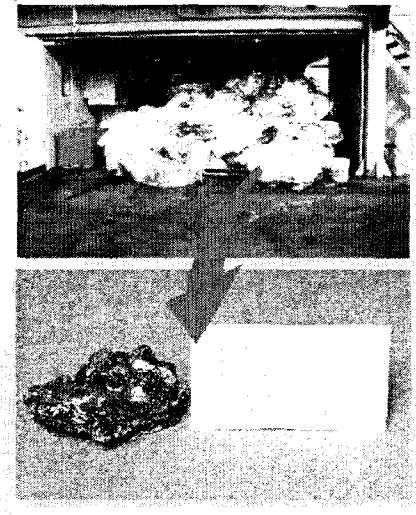




Advantages of PAWDS

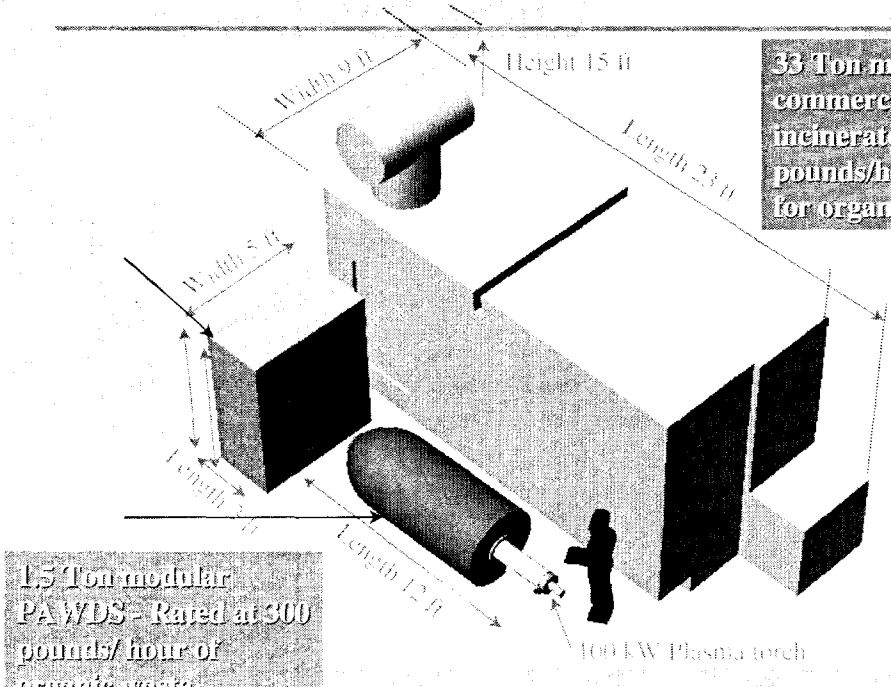
- Controlled thermal chemistry
- Complete gasification of organic waste and vitrification of inorganic waste
- Reduces volume of off-gas as much as 3:1 versus incineration
- Large (≥ 75:1) waste volume reduction
- Little waste material (35 g/sec) in system at any instance
  - Rapid shut-down
- Eductor (cold-wall) design
  - Reduces system size & weight
  - Allows fast start-up
  - Provides robust components
- Allows integrated approach to shipboard waste management as recommended by Naval Studies Board

Ten days solid waste USNS Big Horn, T-AO 198



Slag formed from Navy Solid Waste

Comparison Between COTS and Plasma Arc Waste Destruction System (PAWDS)



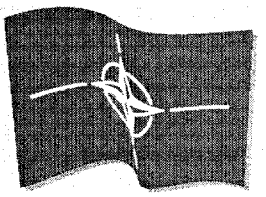
33 Ton multistage commercial marine incinerator - Rated at 365 pounds/hour maximum for organic waste

1.5 Ton modular PAWDS - Rated at 300 pounds/ hour of organic waste

Pollution Prevention Challenges

- Incorporating Pollution Prevention Throughout the Acquisition Process
  - Initial Design Through Production
  - Prime Contractors
    - Second Tier Suppliers
    - Third Tier Suppliers
- Operations and Maintenance
- Disposal

Implementation

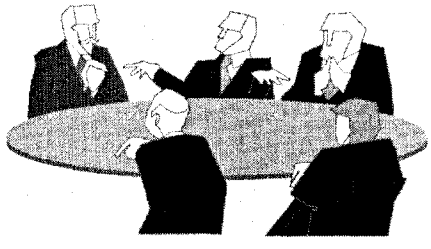


International Cooperation

- TTIAG Special Working Group 12
- NATO Staff Target
- Joint AMEPP 4 / AMEP 59 with NG/6 on Functional Requirements for MEP
- US/UK Joint Feasibility Study
- Performance and Procurement Specifications being Incorporated into New Building Requirements

Industry Studies The Problem

- IHAG Pre-Feasibility Study on Environmentally Sound Ships
- Shipboard Thermal Waste Treatment Conference
- Shipboard Liquid Waste Treatment Conference
- Shipboard Solid Waste Treatment Conference



Defense Research Group Engaged

- Long Term Scientific Study (LTSS) 44 Recommendations
  - Include Environmental Considerations in Ship Design
    - ANEPP 4 / ANEP 59
  - Identify and Prioritize Technology Gaps
    - Technical Experts Meetings
  - Investigate Selected Technologies Through International Cooperation
    - Technical Experts Meetings
    - UK/US Feasibility Study

DRG LTSS/44 Recommendations (cont.)

- Important Technologies for Cooperation
  - Clean Thermal Destruction
    - PAWDS - US
  - High Performance Oil Filtering Equipment
    - Membrane Technology - GE/IL/UK/US
  - Aerated Wastewater/Membrane Treatment System
    - Memorane Bio-Reactors - CA/GE/US
  - Effluent Quality Monitors
    - RDT&E - CA/US
- Examine Integrated Waste Treatment Systems
  - UK/US Feasibility Study

Continued Cooperation

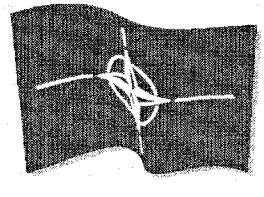
- Research and Technology Agency
- Committee for the Challenges of Modern Society
- Outreach To Cooperation Partners
  - MEP Symposia
    - Held in Bulgaria, The Netherlands, and Poland
  - SWG/12 Expert Teams
    - MARPOL and Oil Spill Teams Visits to Bulgaria and Romania

Controlling Our Destiny

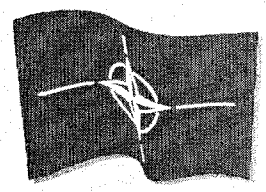
- Working with National Delegations to IMO/MEPC to Write Technically Sound, Achievable and Affordable Rules
  - Participating in Revisions to MARPOL Annex I (Oil Pollution) and the Technical Requirements for Oil Filtering Equipment
- Working with National Legislation Process to Achieve Similar Goals

Opportunities for Standardization

- STANAG 7141 on Environmental Protection
- Joint/Combined Environmental Doctrine
- Navy Doctrine
- Environmental Annex to Operation Plans and Orders
- Environmental Planning
  - Oil Spill Contingency Plans
- Exercises



Conclusions



- SWG/12 is Extremely Valuable to NATO Navies
- NATO Nations are Working Together to Share Information and Technology
  - Including Outreach to Cooperation Partners
- DRG LTSS/44 Recommendations have been Incorporated into the SWG/12 Plan of Work
- Many Opportunities for NATO Standardization and Interoperability

AC/141(SWG/12)

Partners For Peace